High Pressure Speed of Sound Measurements and the Calculation of Densities for Selected Aqueous Sugar Systems

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Vibrating tube densimeters permit direct measurements of the densities of aqueous solutions over a wide range of temperatures. However, many of these instruments are limited to maximum operating pressures of approximately p = 30 MPa. Fortunately there are other non-direct experimental techniques which permit aqueous solution densities to be calculated to approximately p = 200 MPa. This paper describes a method that utilizes both approximation and the integration of precise high-pressure speed of sound data to obtain densities for aqueous solutions under extreme pressure conditions. In particular this paper reports the concentration dependences of speed of sound data, densities, and apparent molar volumes, apparent molar isentropic compressibilities, and apparent molar isothermal compressibilities for selected aqueous sugar systems over a wide range of pressures at T = 298.15 K. The calculated thermodynamic parameters are analyzed in terms of functional group additivity and the resulting parameters are compared with those previously reported in the literature.